UNIVERSITI PUTRA MALAYSIA

FUNCTIONAL CHARACTERIZATION OF YIRO10W (DSN1) AND YOR228C GENES IN SACCHAROMYCES CEREVISIAE

YIAP BEOW CHIN.

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FUNCTIONAL CHARACTERIZATION OF *YIR010W (DSN1)* AND *YOR228C* GENES IN *Saccharomyces cerevisiae.*

By

YIAP BEOW CHIN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of Requirement for the Degree of Doctor of Philosophy.

December 2004

To my parents, wife, son and daughter.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

FUNCTIONAL CHARACTERIZATION OF *YIR010W (DSN1)* AND *YOR228C* GENES IN *Saccharomyces cerevisiae*.

By

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December 2004

Chairman: Associate Professor Raha Abdul Rahim, Ph.D.

Faculty: Food Science and Biotechnology

The aim of this project was to functionally decipher two novel genes of *Saccharomyces cerevisiae* (*YOR228C* and *YIR010W*). Four levels of study were undertaken to achieve the aims of this study including bioinformatics data mining and prediction, gene deletion study, phenotypic analysis and protein profiling. Sequence analysis of *YOR228C* predicted the expression of a 34 kDa transmembrane protein of low abundance with the potential of forming a homodimer. It could be a stress-responsive gene that also regulates cell growth in yeast but it was not an essential component of the cell. On the other hand, Yir010wp has a size of 66 kDa and would be a heterodimer in a complex. This low abundant protein may be related to cell division cycle as it was found to be incorporated within the yeast spindle pole body. The necessity for its exact stoichiometry was a sign of gene dosage sensitivity as demonstrated by the reduction in heterologous fitness. Deletion of a single copy of *YIR010W* caused chromosomal segregation error leading to aneuploidy. Furthermore, double knockout of the gene from the genome was

lethal, implying its essentiality to the yeast cell. As a whole, this study has successfully elucidated the general functions of the two genes under investigation, namely the relationship between *YOR228C* to growth/stress-response and the link between *YIR010W* to the cell division cycle.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENCIRIAN FUNGSI GEN-GEN *YIR010W (DSN1)* DAN *YOR228C* DALAM *Saccharomyces cerevisiae.*

Oleh

YIAP BEOW CHIN

DISEMBER 2004

Pengerusi: **Profesor Madya Raha Abdul Rahim, Ph.D.**

Fakulti: **Sains Makanan dan Bioteknologi.**

Tujuan projek ini adalah untuk mengetahui fungsi dua gen yis *Saccharomyces cerevisiae* yang baru iaitu *YOR228C* dan *YIR010W*. Empat tahap penyelidikan telah dijalankan untuk mencapai matlamat projek ini, termasuk pencarian data dan ramalan menggunakan bioinformatik, penyelidikan pemadaman gen, analisis fenotip dan pemprofilan protein. Analisis jujukan *YOR228C* diramalkan untuk menghasilkan satu protein transmembran bersaiz 34 kDa dan mempunyai jumlah yang sedikit serta berpotensi menjadi homodimer. Ia berkemungkinan adalah suatu gen yang bertindakbalas terhadap tekanan dan juga regulasi pertumbuhan sel yis, tetapi ia adalah komponen yang tidak penting untuk sel. Sebaliknya, Yir010wp mempunyai saiz 66 kDa dan boleh menjadi heterodimer dalam suatu kompleks. Protein berjumlah kecil ini sememangnya berkaitan dengan proses penduaan sel apabila ia didapati melekat kepada badan kutub spindal (spindle pole body) yis. Keperluannya dalam stoikiometri yang betul merupakan suatu tanda kepekaan terhadap dos gen sebagaimana ditunjukan oleh kekurangan

kecergasan heterologus. Permadaman satu gen *YIR010W* menyebabkan kesilapan dalam pembahagian kromosom dan seterusnya menghasilkan aneuploidi. Tambahan pula, pemadaman kedua-dua gen tersebut boleh membinasakan sel yis; menunjukkan kepentingannya terhadap sel tersebut. Secara keseluruhannya, projek ini telah berjaya menerangkan secara ringkas fungsi kedua-dua gen yang dikaji, di mana *YOR228C* merupakan gen yang berkaitan dengan tindakbalas terhadap tekanan dan pertumbuhan manakala *YIR010W* berhubungan dengan proses penduaan sel.

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I certify that an Examination Committee met on 3rd September 2004 to conduct the final examination of Yiap Beow Chin on his Doctor of Philosophy thesis entitled "Functional Characterization of YIR010W (DSN1) and YOR228C Genes in *Saccharomyces cerevisiae*" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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Date: 30 NOV 2004

This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The Members of the Supervisory Committee are as follow:

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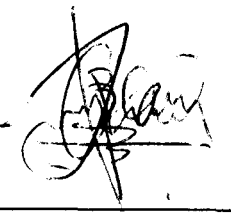
Date: 10 DEC 2004

I hereby declare that the thesis is based on my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



YIAP BEOW CHIN

Date: 8/12/2004

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES